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HINTS FOR USE OF THE WHEATLAND-TYPE PLOWS FOR BRUSH
ERADICATION IN CONNECTION WITH RANGE RESEEDING

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The wheatland plow is doubtless our best all around implement for brush eradication despite the fact that no manufacturer has designed one specifically for work in sagebrush. This accounts for much of our trouble. There are differences between wheatland plows but probably the differences between crews operating them are more important. Much of the trouble stems from lack of experience. We believe that training and use of the following suggestions, which are merely the combined experiences of many crews, will improve our results until real sagebrush plows are made. We hope that much of the information contained in this paper will also be helpful in designing such a plow.

The following suggestions are based in part on the experience of the authors on several administrative reseeding projects of the Forest Service and Grazing Service--and they are meant to apply to similar projects whether on public or private lands. The recommendations are based also on information obtained orally or in writing from implement dealers and manufacturers, farm contractors, publications on agricultural engineering, and foremen of crews who have had experience in wheatland-plowing sagebrush. We have attempted to digest and summarize information on the operation of 18 different plows of four makes.

Recommendations

When the purchase of a plow is being considered, it is natural to ask "Which is best for brush?" It is not the purpose of this paper to answer this question. Opinion is divided, although on some features certain makes appear to excel others. This is brought out in table 1. Each "+" sign indicates that an operator has reported the plow as strong in that feature while the "-" sign is used to indicate a reported weak feature. Features that cause trouble have doubtless attracted more attention than those that are trouble-free. Hence, where no sign is given it seems safe to assume that the feature is satisfactory. Most of those who reported on weak and strong points of plows had not used more than one make under comparable conditions.

Because of differences in working conditions and in crews and also because of too limited sampling, the data of table 1 do not show which make of plow is best. The data do suggest that certain features need strengthening in all plows.

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The list of features considered in table I will be followed as an outline in making suggestions for more efficient operation. Most of these features are also shown in figure 1.

Effectiveness of brush eradication depends on proper setting and adjustment of the plow even more than on size of brush or condition of the ground. Experience has shown that the plow should be set at an angle of 40° to 45° . This is the setting recommended for hard ground or shallow plowing of farm land; the setting that gives the minimum width of cut and at the same time the best kill of brush. The principle is illustrated if we drag a pencil across a table by a string attached to the right of center.

The adjustment is made by moving the line of pull to the right and setting the land wheel to run straight ahead. When the drawbar adjustments are right, the rear end will not swing away from the furrow. The line of pull should also be horizontal so that there is no tendency to raise either the front or back of the plow. The plow should be set level to make all disks cut the same depth, which need not be over 2 inches. As in hand grubbing, sagebrush is found to yield easiest when it is hit 1 to 2 inches below the ground.

Cutting into hard ground is really the job of a disk plow which has disks with greater concavity for penetration. However, use of a full set of wheel weights on each furrow wheel, setting at the minimum angle and mounting a seeder box or other weights on the frame will help in this respect. Except for presence of rocks it would be feasible to get more concave, thinner disks and sharpen them occasionally. Smaller disks, 20 to 24 inches, will cut into hard ground better than the commonly used 26-inch size but they will also clog oftener and wear out bearings faster. They are not recommended for general use in sagebrush.

Adjustment levers sometimes fail to give sufficient clearance when the plow is being walked, or to give the precise depth setting for shallow covering of broadcast seed. Ordinarily in plowing the ratchet cellars at the tops of the axles should be set in the lower holes. It is sometimes necessary to move these to the upper hole. For example, a seeder platform built on the rear of the tractor may foul the lever set for shallow plowing. The upper hole should be used when the plow is to be walked over obstacles. The adjustment is easily made.

The mistake is often made of setting the depth adjustment to plow 4 to 8 inches in striving for better brush kill or greater penetration of hard spots. Since the disks must roll over some of the brush, the deep setting merely adds to draft, loosens the seedbed too much, and covers seed too deep on softer ground. It is better to set the plow at 2 to 3 inches, using what weights are necessary to hold it at that depth on hard ground.

Draft of this kind of plow, when properly set, is 15 to 20 pounds per inch penetration per disk in moist, loose ground. This is increased as much as 50 percent in sod and 100 percent in hard, dry ground. The effect of sagebrush on draft is unknown but evidently is less than that of sod. The



Table I. Wheatland-type plows. Summary of strong and weak points on 18 plows of four makes.

Make of Plow	A	B	C	D
No. of plows evaluated	9	4	3	2
<u>Features Considered:</u>				
<u>Effectiveness of brush eradication</u>	- +++++	++	+	
<u>Cutting into hard ground</u>	---	+	-	+
<u>Adjustability</u>	+	-		
<u>Draw</u>	+++	+	-	
<u>Hitch</u>				
Strength	-		+	-
Design	---	--	-	+
<u>Disk Gang</u>				
Disks	- +++	+++	++	- +
Arbor Shaft	----- ++	---	+	-
<u>Frame</u>				
Strength	--- +++	-	+	- ++
Clearance	-- +++	-		+
Bolts	---- +++		++	- +
<u>Castings</u>	--- +	-		-
<u>Bearings</u>	-----	--	-	
<u>Steering rods</u>	----		- +	-
<u>Lower lift</u>	-	-		
<u>Wheel axle</u>	---			
<u>Seeder attachment</u>		++		
Position	---			
Feeds		+		
Drive chain	-			
Land measure		+		

This summary was compiled from our own observations and from information furnished by these personnel: Grazing Service--T. J. Gayder, E. H. Holman, G. F. Trescantes, W. M. Parsons; Forest Service--J. Gardner, R. Hollock, H. Sweetwood, L. Heywood, G. Allred, O. Torgerson, R. H. Park; Soil Conservation Service--J. Taylor.

secret of getting light draft in plowing brush is in having the three plow wheels aligned parallel with the tractor tracks. If the land wheel slips or runs toward the center, the line of pull of the hitch is too far left on the frame. A center hitch on the tractor is desirable. Also plowing as shallow as consistent with a good brush kill and proper seed covering will lighten the draft.

The hitch in some instances gives trouble as a result of using a crawler tractor with a plow hitch designed for wheel tractors. Most of such hitches are soon broken in turning because they are a foot or so too short. A properly designed hitch, if found to be too weak, can be strengthened by welding angle iron to it, preferably after the proper hitch adjustment has been found by trial. One operator suggests extending the tractor drawbar when the plow hitch is too short. It is unwise to use a plow tongue that requires the tractor operator to pay much attention to keeping it free of the tracks. Too many other points need attention if a good job of seeding is to result.

Hitches are also broken by operators who try to back the plow to get clear of brush. These plows cannot be backed. It is better to carry a short chain or cable, unhitch, and pull the plow off the brush pile from the rear.

Two-plow hitches are available making it possible for a 60 hp. or larger crawler tractor to accomplish nearly double the work with no increase in manpower. A 2-plow outfit on level ground can plow and seed 25 acres in an 8-hour shift. Specifications for these hitches can be obtained from the U. S. Bureau of Land Management, Box 751, Reno, Nevada or by asking the International Harvester Co., 180 N. Mich. Ave., Chicago for its leaflet on the two-plow hitch CWTIH-15. The make of the lead plow determines certain details in design of the hitch.

Disk gangs, though usually satisfactory, are subject to a variety of troubles when used in brush and rocks. As suggested in the table, the arbor shaft or gang bolt is generally too light. Often the tightening nut on the end of the arbor shaft comes loose, allowing a disk to break or lose off, or spacer washers to break. To prevent this, grease the tightening nut and washer then draw the nut down as tight as possible.

Breakage of disks on rocks will be reduced if alloy steel disks are used. Most makers furnish these as special equipment. Larger disks roll more freely and will clear rocks better.

Frames of wheatland plows occasionally break, and wheel axles bend, as for example, when a fast moving front wheel drops into a badger hole. As broken bolts probably cause more time loss than frames, they should be replaced with steel bolts having lock washers. Then all bolts should be inspected or tightened daily. A plow should never be taken out on a project without a good supply of spare bolts of sizes used in the frame and castings. Since trash bars appear to catch brush rather than to help keep the plow clean, they may as well be removed unless it is necessary to work wet, heavy soil.

Castings break so frequently, especially with a new plow on rocky or gullied land, that some foremen have considered it necessary to keep an acetylene welding outfit and a supply of scrap steel on the project. If more than one plow is in use far from the repair shop, it is economical to make repairs on the job. Often part or all of a casting is lost when it breaks or loses a bolt. With ingenuity and the right tools, the crew can often improvise castings and save time while a new part is being obtained.

The bearing that cuts out most often is the one in the front furrow wheel. The life of the bearings can be lengthened in most cases by using more and better grease. A plow in steady use needs greasing twice daily. A farm contractor who changed to a higher grade grease, "lubriplate," reports no more bearing trouble. The grease fittings of the wheel bearings are very hard to reach unless the wheel stops in the right position. Hence, greasing of the wheels is best done before the tractor is shut off. That care of the bearings has much to do with their life is suggested by statements from different operators. One operator finds it necessary to replace them after 1,000 acres, another after 5,000.

As a further precaution against excessive wear on the bearing and to reduce draft, the alignment of the front wheel should be set straight ahead or slightly outward. This wheel should never run outward more than one inch. The practice of crowding the land side of the furrow to increase the width of cut an inch or two may also wear the front wheel bearing excessively.

Steering rods of great strength are needed in sagebrush. Round iron rods have been successfully reinforced by welding angle iron the full length to prevent bending. An iron pipe might be slipped over the rod if more convenient than welding. Also care should be taken to avoid right turns as they cause most of the steering rod trouble.

The power lift occasionally fails through wear or being jammed by brush. Proper tension on the assister spring is important. A more frequent trouble results from the brush catching and breaking the trip rope or tripping the lift. The trip lever is sometimes bent by brush. The only remedy, short of new design, may be to weld an extension on the trip lever to hold the trip rope above the brush. By proper use of a good lift, an operator who is alert with the trip rope can often prevent the plow from becoming clogged with brush.

Seeder attachments have proved very much worthwhile for broadcasting while plowing. In all instances that we know of the seeder has been used as a broadcast sower by removing the boots and seed delivery tubes. Most crews have let the seed scatter from the seed cups to mix with the soil as it is turned. Others have made galvanized iron troughs for each seed cup to drop the seed in the wake of the disks. One crew reversed and reset the box. Any method that mixes most of the seed with the top inch of soil will be satisfactory. The land measure feature makes it easy to adjust the rate of seeding. Fluted feeds with gate adjustments are most trouble-free for light grass seeds.

Seeder drive chains that are not protected or protected only by a light shield are subject to breakage by brush. A heavy shield should be made strong enough to crowd brush aside without bending.

The operator's first step should be to obtain and study the maker's guide on its assembling, care, and operation of the plow. It is important to do this while looking at the plow. It is well also to obtain the parts list and keep it with this plow.

Following the manufacturer's guide insofar as it applies to sagebrush eradication is essential to get the best results.



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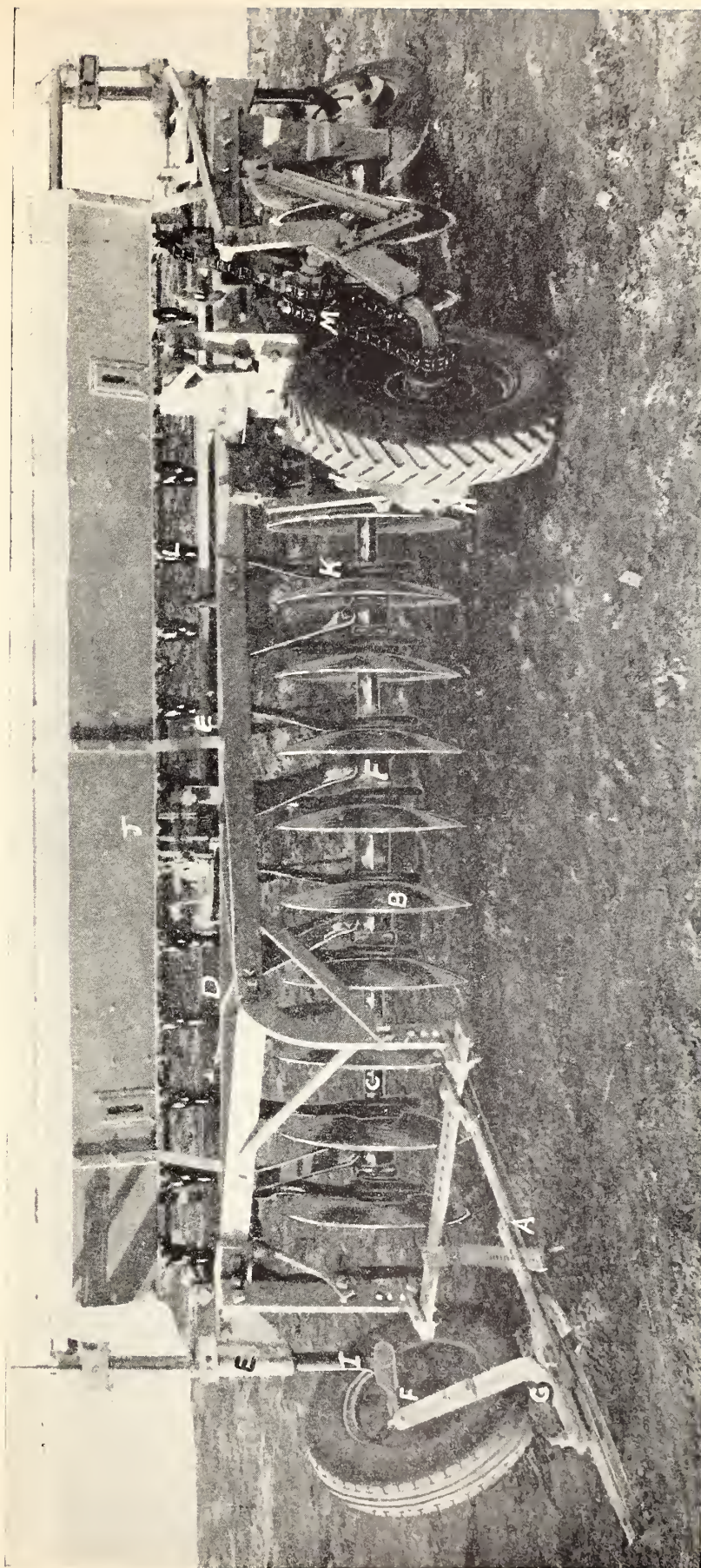


Figure 1. A wheatlant or oneway plow labeled to show features evaluated in table 1. Design and
photograph by the National Farm Machinery Cooperative.

J. Hitch
B. Disk
C. Arbor shaft
D. Frame

E. Casting
F. Bearing
G. Steering rod
H. Power lift

I. Wheel axle
J. Seeder box
K. Seed delivery tube
L. Feed
M. Seeder drive chain

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